## Patent Claims

1. Device for thermally treating semiconductor wafers having at least one silicon layer to be oxidized and a metal layer, preferably a tungsten layer, which is not to be oxidized, whereby the device has the following:

at least one radiation source;

a treatment chamber receiving the substrate, with at least one wall part located adjacent to the radiation sources, said wall part being substantially transparent for the radiation from the radiation source; and

at least one cover plate between the substrate and the wall part of the treatment chamber located adjacent to the radiation sources, whereby the cover plate is of dimensions such that it fully covers the transparent wall part of the treatment chamber in relation to the substrate, in order to prevent material, comprising a metal, metal oxide or metal hydroxide such as tungsten, tungsten oxide or tungsten hydroxide emitted or evaporated from said substrate from becoming reaching the transparent wall part of the treatment chamber.

2. Device in accordance with claim 1, characterised in that the cover plate is substantially non-transparent for the radiation of the radiation source.

3. Device in accordance with claim 1 or 2, characterised in that the cover plate lies loosely on corresponding holding elements in the treatment chamber.

4. Device in accordance with any of the previous claims, characterised by a handling device for automatically removing and inserting the cover plate from the or into the treatment chamber.

5. Device in accordance with claim 4, characterised in that the handling device is only in contact with the cover plate on a surface facing away from the substrate.

6. Device in accordance with any of the previous claims, characterised in that the handling device for the cover plate is also provided for the loading and unloading of substrates.

7. Device in accordance with any of the previous claims, characterised by at least one cover plate each above and below the substrate.

8. Device in accordance with any of the previous claims, characterised in that different cover plates are provided above and below the substrate.

9. Device in accordance with any of the previous claims, characterised in that the surface of the cover plate facing the substrate is coated.

10. Device in accordance with claim 9, characterised in that the coating consists of a material which is easy to clean.

11. Device in accordance with any of the previous claims, characterised by a light-absorbing plate between the cover plate and the transparent wall part of the treatment chamber.

12. Device in accordance with any of the previous claims, characterised in that the cover plate consists of glass, in particular quartz glass.

13. Device in accordance with any of the previous claims, characterised in that at least one device is provided for introducing a non-watery, process gas containing hydrogen into the treatment chamber.

14. Device in accordance with claim 13, characterised by a control unit for introducing the non-watery process gas containing hydrogen before and/or after the introduction of a hydrogen / water mixture.

15. Method for thermally treating semiconductor wafers having at least one semiconductor layer to be oxidized, preferably a silicon layer, and a metal layer, e.g. a tungsten layer, which is not to be oxidized, whereby the semiconductor wafer is in a treatment chamber with at least one radiation source and a wall part located adjacent to the radiation source, said wall part being substantially transparent for the radiation of the radiation source, whereby the method has the following steps:

introduction of at least one process gas into the treatment chamber;

heating of the wafer, whereby material emitted from or evaporating from the substrate comprises a metal, metal hydroxide or metal oxide, and the material is deposited or adsorbed on at least one cover plate between the wafer and the transparent wall part of the treatment chamber, so as to prevent it from reaching the transparent wall part of the treatment chamber.

16. Method in accordance with claim 15, characterised in that the cover plate is removed from the treatment chamber and cleaned between substrate treatments.

17. Method in accordance with claim 15 or 16, characterised in that during the thermal treatment, at least one non-watery process gas containing hydrogen is introduced into the treatment chamber.

18. Method in accordance with claim 17, characterised in that the non-watery process gas containing hydrogen is introduced into the process chamber before and/or after the introduction of a mixture
of hydrogen and water.

19. Method in accordance with claim 18, characterised in that the water content of the hydrogen / water mixture is controlled in such a way that oxidation of the metal by the oxygen contained in the water and a reduction of the metal oxide created hereby is substantially kept in equilibrium by the hydrogen.

20. Method in accordance with claim 19, characterised in that the proportion of water in the mixture is less than 20% and in particular around 14%.

21. Method for thermally treating semiconductor substrates with at least one structure S in a process chamber by means of at least one thermal treatment cycle, whereby the structure S has at least two different materials A, B, and at least a first material A with a first component X of a process gas can form a first material a which is described by a first equilibrium reaction

A + X <=> a + a'

and the second material B with a second component Y of the process gas can form a second material b which is described by a second equilibrium reaction

B+Y <=> b + b', whereby

a' and b' are optional reactants, and

whereby during the thermal treatment, for at least an interval of time, at least one concentration of a component X,Y of the process gas and at least a further process parameter are chosen in such a way that the first equilibrium reaction is displaced to the first material A and the second equilibrium reaction displaced to the second material b, and whereby at least one concentration and/or a partial pressure of at least one component X, Y of the process gas is constantly changed as a function of the further process parameter.

22. Method in accordance with claim 21, characterised in that at least one gas flow meter is regulated or controlled dependent upon the further process parameter.

23. Method in accordance with either of the claims 21 or 22, characterised in that, by means of a pump device the total pressure or a partial pressure within the process chamber is set.

24. Method in accordance with any of the claims 21 to 23, characterised in that into a volume filled with a first process gas, a second process gas with defined composition is introduced.

25. Method in accordance with claim 24, characterised in that the volume is variable.

26. Method in accordance with any of the claims 21 to 25, characterised in that the time interval is within a thermal treatment cycle.

27. Method in accordance with any of the claims 21 to 26, characterised in that the time interval extends over several thermal treatment cycles.

28. Method in accordance with any of the claims 21 to 27, characterised in that the first equilibrium reaction substantially takes place within a thermal treatment cycle and the second equilibrium reaction substantially takes place within another thermal treatment cycle.

29. Method in accordance with any of the claims 21 to 28, characterised in that the further process parameter is the process temperature and/or a temperature of a material A, B and/or of a material a, b of the structure S.

30. Method in accordance with any of the claims 21 to 29, characterised in that the further process parameter comprises a further gas concentration of a component of the process gas, the pressure of the process gas, a partial pressure of a component of a process gas, a magnetic field of predetermined strength, a portion of UV or a combination of the aforementioned parameters which act upon the semiconductor.

31. Method in accordance with any of the claims 21 to 30, characterised in that the structure has horizontal layers with at least one material A, B.

32. Method in accordance with any of the claims 21 to 31, characterised in that the structure has vertical layers with at least one material A, B.

33. Method in accordance with any of the claims 21 to 32, characterised in that the materials A, B are separated by at least one material C different to A and B.

34. Method in accordance with any of the claims 21 to 33, characterised in that the second material b forms on material B.

35. Method in accordance with any of the claims 21 to 34, characterised in that the semiconductor substrate comprises a silicon wafer, a crystalline or amorphously grown or deposited semiconductor layer, a substrate or a layer of IV-IV semiconductor, II-VI semiconductor or III-V semiconductor.

36. Method in accordance with any of the claims 21 to 35, characterised in that the first material A comprises a metal and the second material comprises a semiconductor B.

37. Method in accordance with claim 36, characterised in that the metal of the first material A is covered by a metal oxide or metal nitride layer which comprises or forms the first material a and

which can be formed e.g. by means of the first equilibrium reaction.

38. Method in accordance with claim 36 or 37, characterised in that the semiconductor of the second material B is at least partially covered by an oxide, nitride or oxy-nitride layer which comprises or forms the second material b, and which can be formed e.g. by means of the second equilibrium reaction.

39. Method in accordance with any of the claims 21 to 38, characterised in that the first component X and the second component Y are the same or they at least comprise a same material.

40. Method in accordance with any of the claims 21 to 39, characterised in that the optional reactants a', b' are the same, or at least comprise a same material.

41. Method in accordance with any of the claims 21 to 40, characterised in that the first component X and the second component Y comprise water.

42. Method in accordance with any of the claims 21 to 41, characterised in that the reactants a', b' comprise hydrogen.

43. Method in accordance with any of the claims 21 to 42, characterised in that the first and/or second component X, Y comprises a mixture of water and hydrogen.

44. Method in accordance with any of the claims 21 to 43, characterised in that the first and/or second component X, Y comprises a mixture of water and oxygen.

45. Method in accordance with any of the claims 21 to 44, characterised in that the first and/or second component X, Y comprises a first mixture of water and hydrogen or a second mixture of water and oxygen and that during the thermal treatment, the first and/or the second component X, Y is transferred from the first mixture into the second mixture, or vice versa.

46. Method in accordance with any of the claims 21 to 45, characterised in that at least the material A and/or the second material b comprises a protection layer which is formed and/or maintained by means of a protection layer-forming reactive process gas component during the thermal treatment, and which makes it possible, at least for a short time, to process the semiconductor substrate in parameter areas with regard to the

concentration of the process gases and at least one further parameter, preferably of the temperature of the semiconductor substrate, in which the equilibrium reaction is displaced to the first material a and/or to the second material B.

47. Method in accordance with any of the claims 21 to 46, characterised in that the process gas comprises ammonia, at least during part of the thermal treatment.

48. Method in accordance with claim 46, characterised in that the protection layer-forming reactive process gas component comprises ammonia.

49. Method in accordance with any of the claims 21 to 48, characterised in that at least one of the materials A, B or the materials a, b comprises tungsten, molybdenum, platinum, iridium, copper and/or the oxides or nitrides of the same, such as tungsten oxide and/or tungsten nitride.

50. Method in accordance with any of the claims 21 to 49, characterised in that the thermal treatment is carried out in a process chamber of a rapid thermal processing unit.

51. Method in accordance with any of the claims 21 to 50, characterised in that the process chamber comprises at least one covering device between the semiconductor substrate and at least one process chamber wall for at least partial covering of the process chamber wall.

52. Method in accordance with claim 50, characterised in that the rapid thermal processing unit is temperature- calibrated in a temperature range of between 930°C and 950°C, and that the temperature calibration makes use of the layer grown of a tungsten nitride layer in ammonia.